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DIABETES AS A CAUSE OF PARKINSON'S DISEASE

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Abstract

Parkinson's disease is the second most common degenerative disease of the human nervous system after Alzheimer's disease. Scientists fully believe that Parkinson's disease is a progressive disease of the nervous system that is caused by the degeneration of dopaminergic neurons. Diabetes is a chronic metabolic disease characterized by high levels of blood glucose (or blood sugar), which over time leads to serious damage to the heart, blood vessels, eyes, kidneys and nerves. PD should be considered a systemic disease and not simply a neurodegenerative disorder, as non-neurological processes such as DM may determine the development and exacerbate the severity of the neurodegenerative process. The purpose of this work is that, based on our research, we can prove whether diabetes really contributes to the development of Parkinson's disease. This is a retrospective paper, where retrospectively collected data were used, from the database in the Department of Neurology in Skopje, for a period of 10 years, from January 2014 to February 2024, for hospitalized patients. Based on the descriptive results of the crosstabulation of patients with Parkinson's and diabetes, it turns out that there is a weak relationship between these two diseases. previous studies exploring the link between diabetes and the risk of Parkinson's disease produced inconsistent results, with the methodology of these studies varying significantly. Furthermore, most of these studies were quite small in size with case cohorts of ~200–500 patients. In this time that we live, with such a rapid spread and development of diseases, we must emphasize that we must expand our fight against the factors that cause the disease, not only in the central nervous system, but also aim at every preventive measure that can slow down neurodegeneration.

Keywords: dopamine, antidiabetics, tremor, aged patient.

1. Introduction

Parkinson's disease is the second most common degenerative disease of the human nervous system after Alzheimer's disease. (Tysnes OB, Storstein A (2017). Scientists fully believe that Parkinson's disease is a progressive disease of the nervous system that is caused by the degeneration of dopaminergic neurons (Aarsland et al. 2003). This on the other side leads to a disturbance of the neurohumoral balance in the basal ganglia, causing the appearance of the characteristic symptoms of the disease. (Eriksen et al. 2005) This disease is characterized by a progressive movement that is manifested by symptoms such as: tremors (of the hands, arms, legs, jaw and face). (Fahn 2003; Parkinson 1817). Not all clinical symptoms that appear in the course of PD can be explained by the lack of dopamine in the nigrostriatal system. These include autonomic dysfunction, pain, hyposmia or anosmia, sleep disorders with rapid eye movement (REM), depression, anxiety, cognitive decline, and dementia. People affected by this disease have a high level of disability and have need by more than one person. (Carmen et al. 2022; Galvin et al. 2001). Although there is no cure for Parkinson's disease, medication, medical treatment and other therapies can often relieve some symptoms. (Stolze et al. 2001). The disease usually affects elderly people, but younger people can also be affected. Men compared to women are more predisposed to disease. (World Health Organization. 2023). With growing life expectancy and global aging of the population, between 2015 and 2040 we will have a doubling of PD cases. (Marras et al. 2018; Athauda D, Foltynie T 2016).

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Diabetes is a chronic metabolic disease characterized by high levels of blood glucose (or blood sugar), which over time leads to serious damage to the heart, blood vessels, eyes, kidneys and nerves. (Amit Sapra, Priyanka Bhandari. 2023)
Diabetes and Parkinson's disease are both age-related diseases that are becoming epidemic worldwide. Diabetes mellitus and insulin resistance not only increase the likelihood of developing Parkinson's disease, but can also determine the prognosis and progression of Parkinson's symptoms. (Carmen et al. 2022)
The incidence of Parkinson's disease in patients diagnosed with type 2 diabetes varies substantially depending on the diabetes therapy received. (Ruth et al. 2020)
Diabetes Mellitus and Parkinson's disease share common molecular mechanisms, such as protein misfolding, mitochondrial dysfunction, oxidative stress, chronic inflammation, and microbial dysbiosis. Recently, epidemiological and experimental studies have reported that diabetes affects the incidence and progression of Parkinson's disease. (Haiyang et al. 2002) (Klara et al. 2021).
People with type 2 diabetes have a higher risk of developing Parkinson's disease, and when the disease is in progress, its progression is faster and often more severe. This may be due in part to an apparent relationship in the brain between dopamine, insulin resistance and glucose control. Insulin is not only produced in the pancreas, but is also present in the brain – where it has been shown to affect dopamine levels. (Ruth et al., 2020).
PD should be considered a systemic disease and not simply a neurodegenerative disorder, as non-neurological processes such as DM may determine the development and exacerbate the severity of the neurodegenerative process. Furthermore, this may facilitate new measures to combat PD, but also enable us to identify subjects at high risk for developing PD and therefore provide timely neuroprotective treatments. (Labandeira et al. 2022).
Furthermore, Parkinson's disease and diabetes are reported to share common biologically plausible cellular mechanisms. The insulin receptor is one of the essential targets in substantia nigra neurons, which can be upregulated by hyperglycemia to suppress the firing of substantia nigra dopaminergic neurons and decrease dopamine turnover. (Das RR, Unger MM. 2018).

2. Aim

Considering that Parkinson's disease and diabetes are two of the most frequent diseases in the world, we had the idea to research patients who suffered from Parkinson's disease to see if this disease appears as a result of concomitant diseases such as diabetes. And as the main goal of this work is that, based on our research, we can prove whether diabetes really contributes to the development of Parkinson's disease.

3. Material and methods

This is a retrospective paper, where retrospectively collected data were used, from the database in the Department of Neurology in Skopje, for a period of 10 years, from January 2014 to February 2024, for hospitalized patients. Retrospective studies investigate a phenomenon or issue that took place in the past. Descriptive studies are in cases where the researcher is not in direct contact with the participant, the study includes data collected from existing data, e.g. Medical histories of patients, this material included in this study. The results were processed with the help of the Pearson Chi-Square test 9.527.

4. Results

From a total of 943 patients, whose files we opened, we reached the result that 823 patients who were hospitalized for this period were affected by Parkinson's disease, while 101 were affected by diabetes.

Table 1

		Number of patients	%
Parkinson	No	120	12.73%
	Yes	823	87.27%
Diabet	No	843	89.30%
	Yes	101	10.70%

Based on the descriptive results of the crosstabulation of patients with Parkinson's and diabetes, it turns out that there is a weak relationship between these two diseases, namely the smallest number of subjects with diabetes of 97, also have Parkinson's disease, while 726 patients they are not reported to have diabetes. The relationship coefficient of these two diseases is weak Phi=.101.

Parkinson * Diabet Crosstabulation

			Diabetes		
			No	Yes	Total
Parkinson	No	Count	117	3	120
		% within Parkinson	97.5%	2.5%	100.0%
		% within Diabetes	13.9%	3.0%	12.7%
		% of Total	12.4%	.3%	12.7%
	Yes	Count	726	97	823
		% within Parkinson	88.2%	11.8%	100.0%
		% within Diabetes	86.1%	97.0%	87.3%
		% of Total	77.0%	10.3%	87.3%
Total		Count	843	100	943
		% within Parkinson	89.4%	10.6%	100.0%
		% within Diabetes	100.0%	100.0%	100.0%

Parkinson * Diabet Crosstabulation

			Diabetes		
			No	Yes	Total
Parkinson	No	Count	117	3	120
		% within Parkinson	97.5%	2.5%	100.0%
		% within Diabetes	13.9%	3.0%	12.7%
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		% of Total	77.0%	10.3%	87.3%
Total		Count	843	100	943
		% within Parkinson	89.4%	10.6%	100.0%
		% within Diabetes	100.0%	100.0%	100.0%
		% of Total	89.4%	10.6%	100.0%

Pearson Chi-Square 9.527, df=1, p=.002
Phi=.101, p=.019

5. Discussion and conclusion

Based on the study carried out in the department of neurological disorders in Central Spain (De Pablo-Fernandez et al., 2017), it can be seen that the relationship found between diabetes and Parkinson's disease was not statistically significant. These previous studies included patients with type 2 diabetes mellitus, and existing data regarding the risk of patients with type 1 diabetes mellitus were limited. There is no consensus in the literature as to whether patients with diabetes have a higher risk of Parkinson's disease, or whether there is actually a lower risk or no association at all. Two large prospective studies that find an increased risk for PD in patients with diabetes, one study that finds no association and one study that reports a lower risk of diabetes (Wirdefeldt et al. 2011). Indeed, when we compared the prevalence of Parkinson's disease in patients with diabetes to subjects without diabetes, we found a lower prevalence of Parkinson's disease in a group of individuals without a recorded diagnosis of diabetes. (Claudia et al. 2008)

A recent prospective analysis of data from the Health Professionals Study involving 530 cases of Parkinson's disease found no evidence for a difference in the risk of developing Parkinson's disease between patients with and without diabetes, the prevalence of diabetes was

approximately similar between patients with Parkinson's disease and subjects without the disease. The risk of developing incident diabetes was lower for patients with Parkinson's disease than for patients without the disease (Lu et al. 2014), a finding that is consistent with our observation. Thus, previous studies exploring the link between diabetes and the risk of Parkinson's disease produced inconsistent results, with the methodology of these studies varying significantly. Furthermore, most of these studies were quite small in size with case cohorts of ~200–500 patients. (Yu-Wan et al. 2017).

Epidemiological evidence and experimental data support the interaction between Parkinson's disease and diabetes, and both diseases are increasingly prevalent worldwide, as both are associated with aging. (Carmen et al. 2022).

Based on the results and works that we have analyzed so far, we have noticed that there is a weak correlation between Parkinson's disease and Diabetes. In this time that we live, with such a rapid spread and development of diseases, we must emphasize that we must expand our fight against the factors that cause the disease, not only in the central nervous system, but also aim at every preventive measure that can slow down neurodegeneration

It is more than necessary to continue studying these two diseases, so that a more accurate and comprehensive conclusion can be drawn, based on evidence that will enable us to definitively clarify the risk factors of the Diabetes and Parkinson's disease. We can freely say that poorly controlled diabetes is an additional risk factor that contributes to motor development as a result of Parkinson's disease. In conclusion, we can say that to arrive at more accurate and comprehensive results, more subjects will have to be analyzed, with more parameters, with more sophisticated diagnostic methods, which remains an open battle for research scientific future.

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